Michigan's 21st Century Energy Plan

Thinking About Policies for Meeting Tomorrow's Energy Needs

Tom Stanton, Coordinator
Michigan Renewable Energy Program
Michigan Public Service Commission
http://www.michigan.gov/mrep

Executive Directive 2006-2

… short- and long-term electric needs … met in… optimum manner that assures a reliable, safe, clean, and affordable supply…

… further the state's competitive business climate, grow jobs, and provide affordable rates…

… appropriate use and application of energy efficiency, alternative energy technology, and renewable energy technologies…

… natural resources and the environment… protected from pollution, physical or visual impairment, or destruction, and future risks associated with fossil fuels…

… renewable portfolio standard shall be created that establishes targets for the share of this state's energy consumption derived from renewable energy…

… New technology options to generate, transmit, or distribute energy more cleanly or more efficiently shall be identified…

... The plan shall identify any legislative or regulatory changes necessary to its implementation, together with any financial, funding, or incentive mechanisms needed…

See: http://www.michigan.gov/gov/0,1607,7-168-36898-140415--,00.html

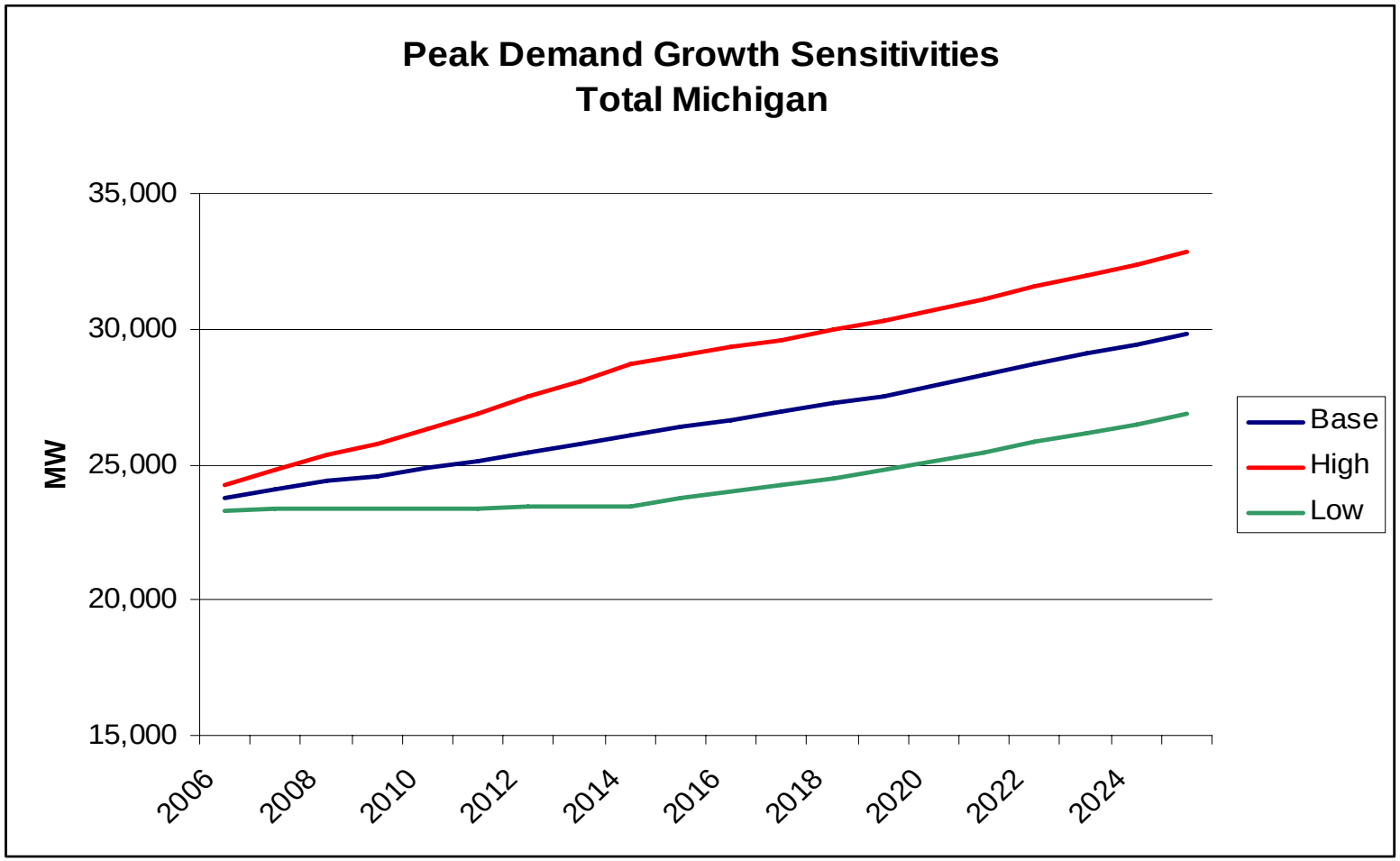
21st Century Energy Plan Process

- April – December, 2006, w/~350 interested parties
- Develop a plan to meet Michigan's short- and long-term *electric* energy needs
- Develop a robust set of policy recommendations designed to address Michigan's electric energy resource needs

Process of Assessing Adequacy

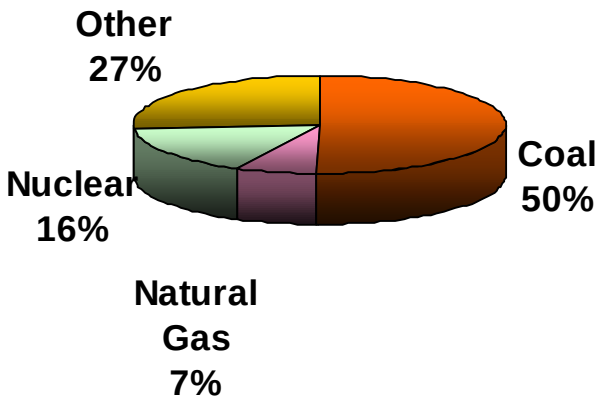
- Forecast of energy and demand growth over short-, intermediate-, and long-term future
- Inventory of current assets (generation and transmission)
- Assessment of adequacy of current assets
- If needed, determination of best resources to acquire

Peak Demand Forecast Sensitivities

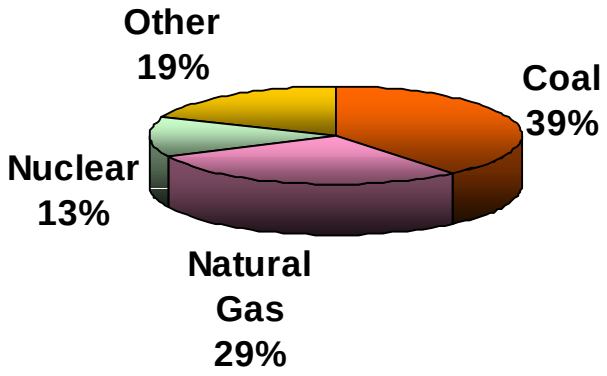


Michigan Electric Generation *Capacity* by Fuel Source

1990



2004

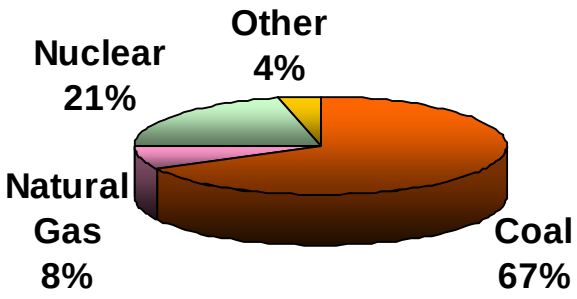


Gas up 22%, Coal down 11%

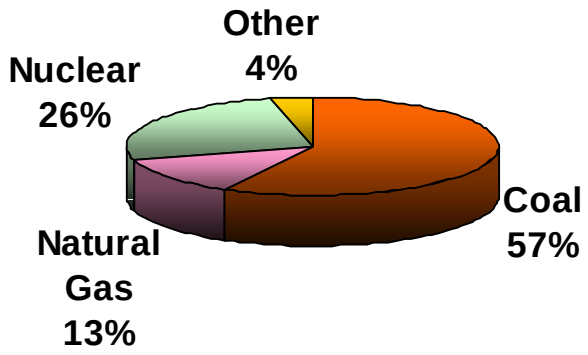
Source DOE EiA

Michigan Electric Generation *Energy* by Fuel Source

1990



2004

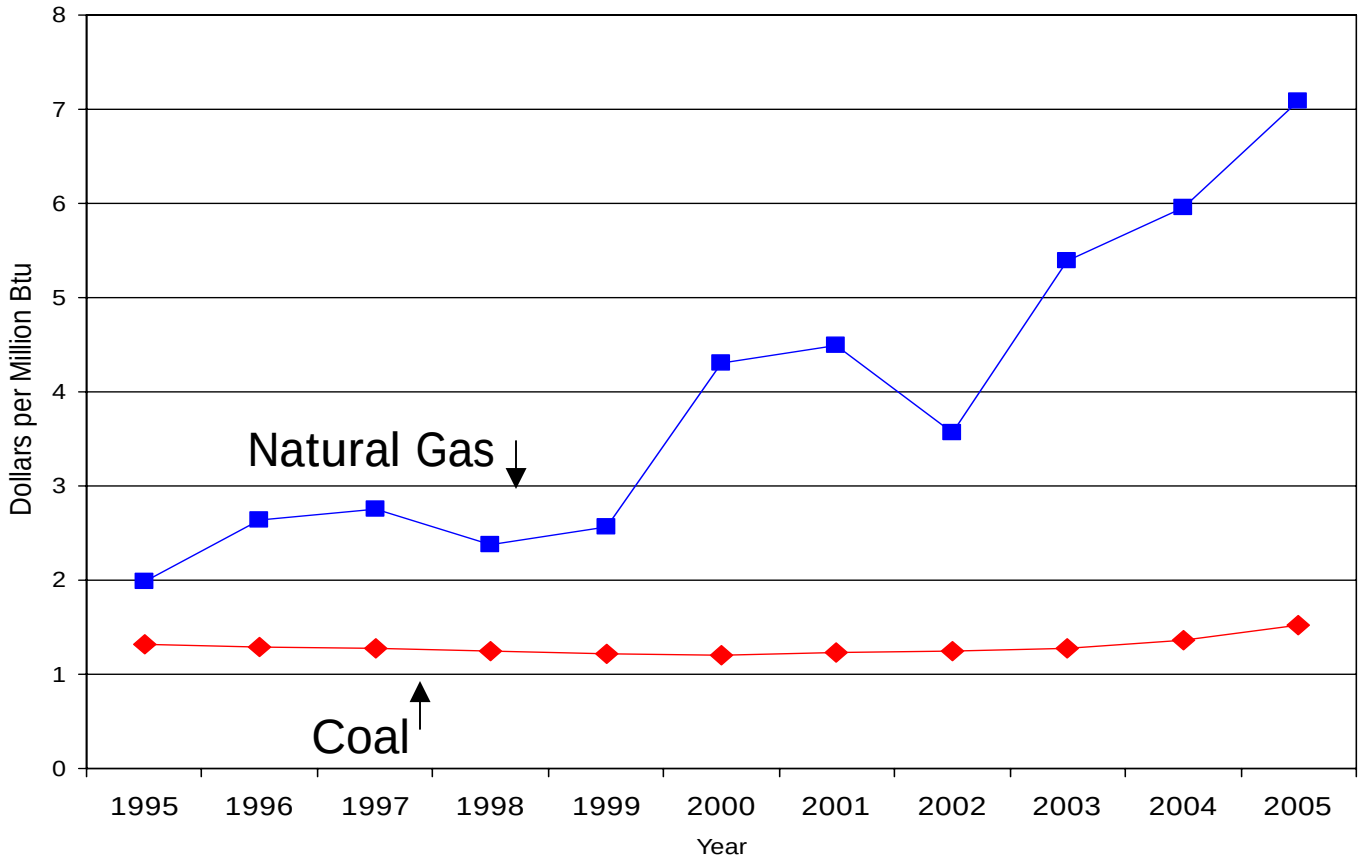


Gas and Nuclear up 5%, Coal down 10%

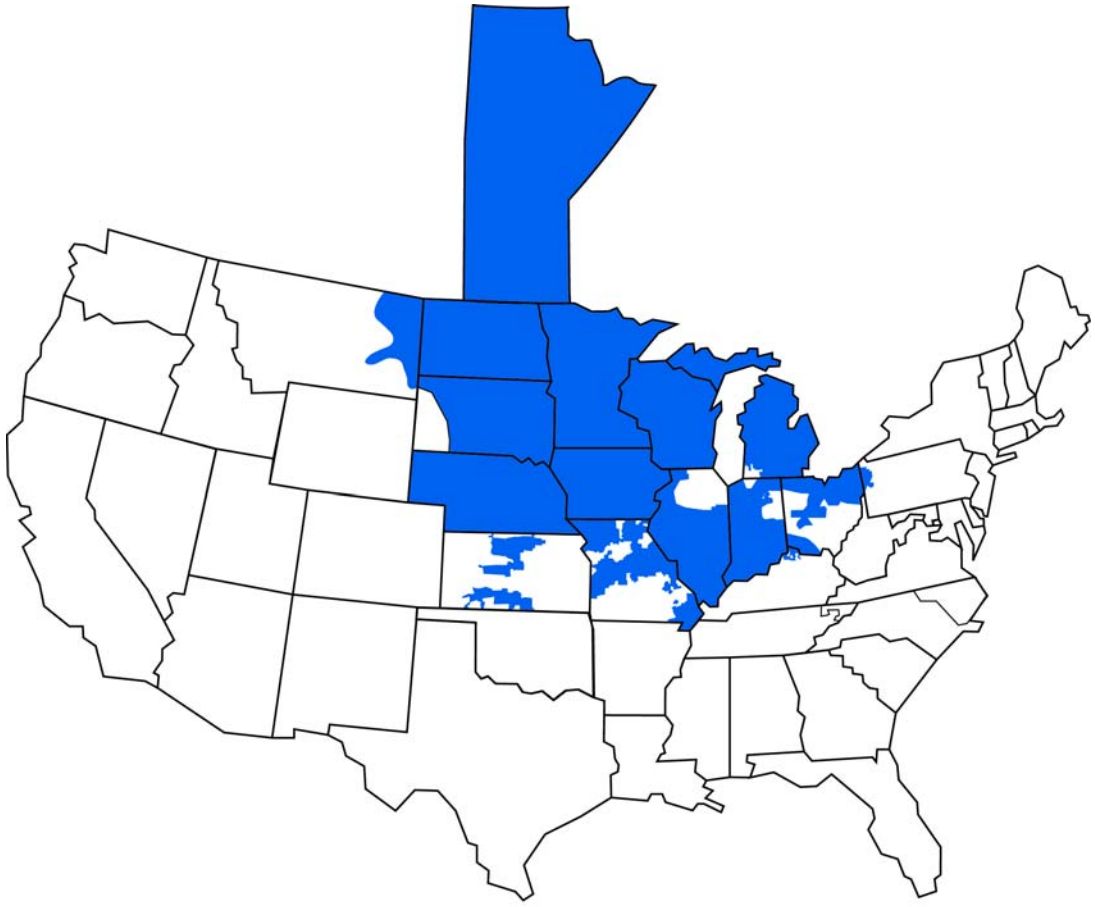
Source DOE EiA

Cost of Fossil-Fuels Receipts at Electric Generating Plants

1995-2005 yearly averages



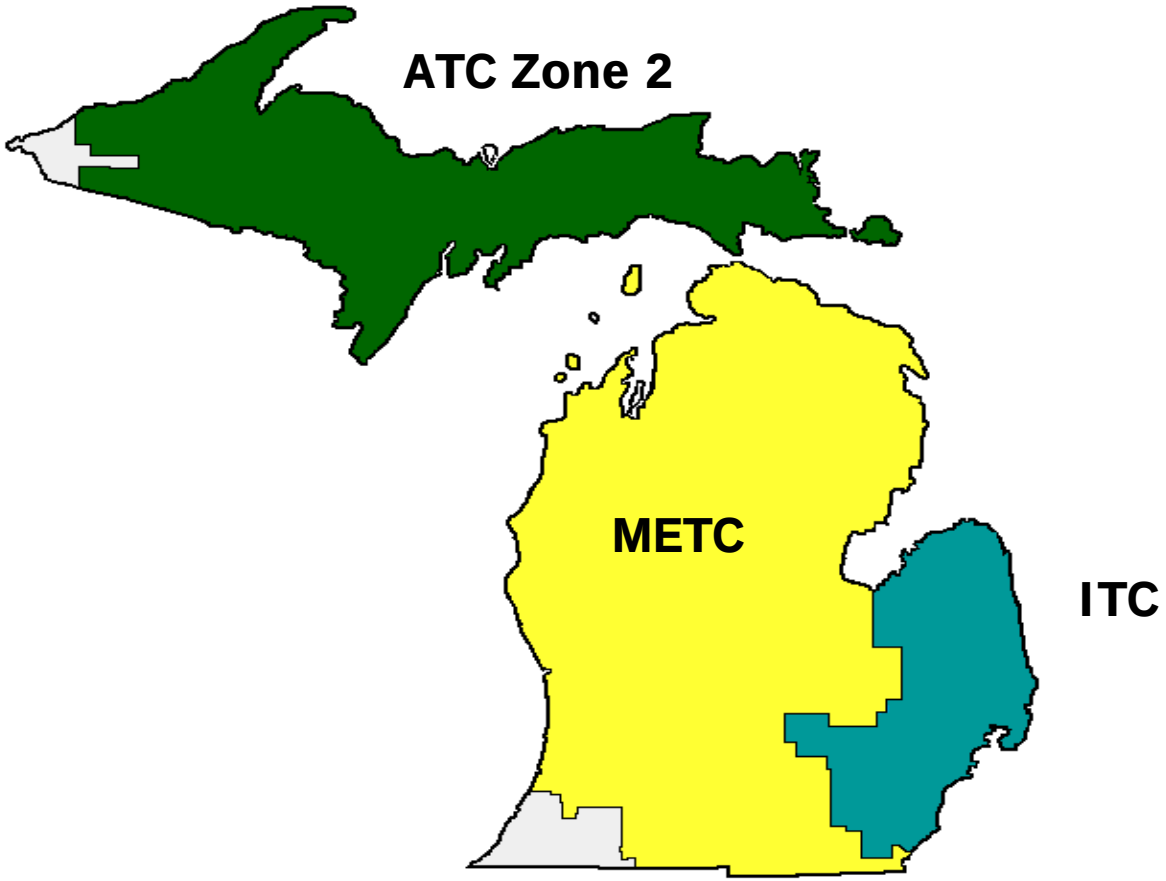
Michigan's Transmission Region



Midwest ISO Regional Reliability Area

Source: http://www.midwestiso.org/page/About%20Us

Electric Transmission Company Michigan Regions

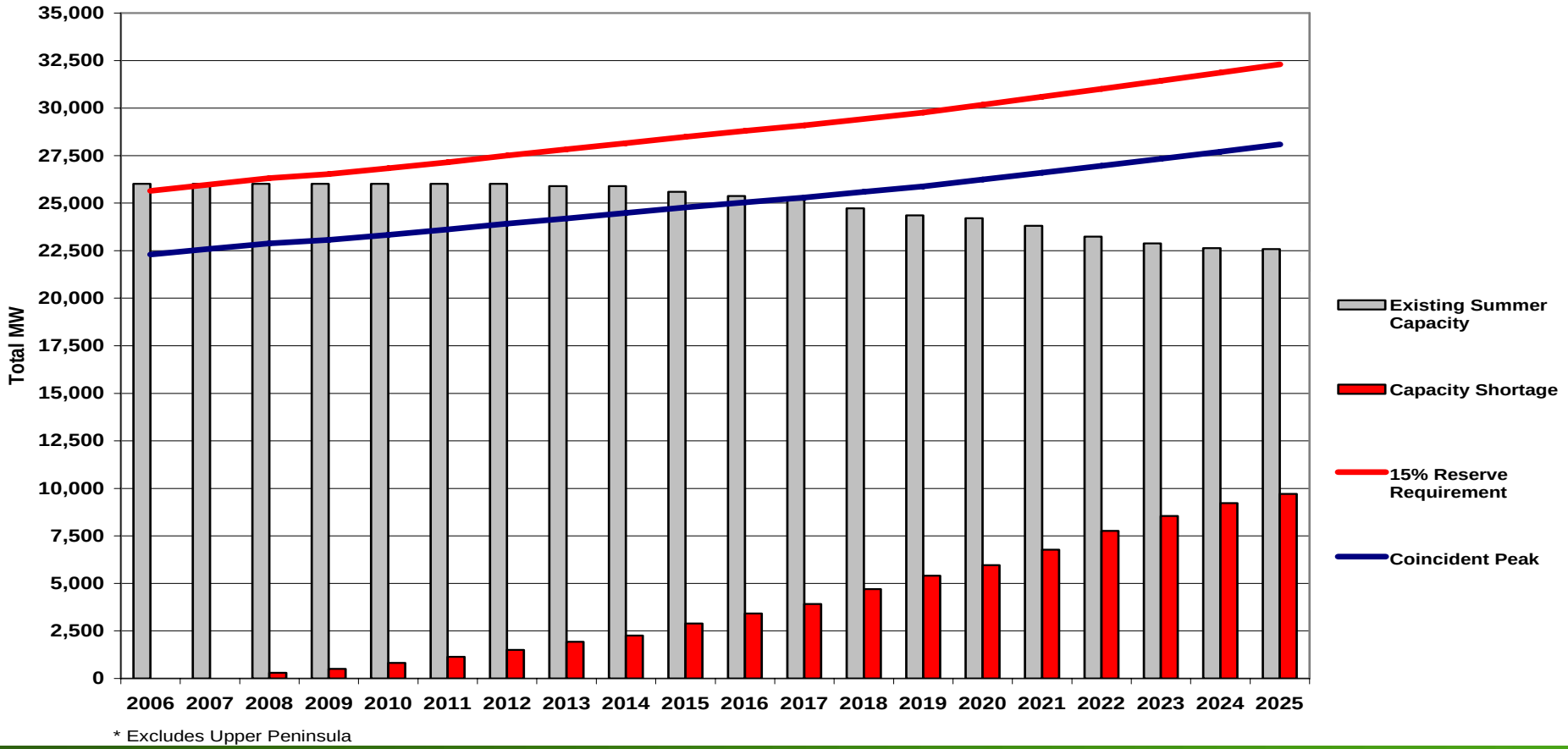


Transmission Capability Into Michigan

- Lower Peninsula
  - 3,000 MW 2009 on-peak
  - 1,500 MW 2009 on-peak with parallel flows
- Upper Peninsula
  - 2005 224 MW
  - 2006 300 MW
  - 2007 300 MW
  - 2008 325 MW
  - 2009 525 MW

Overview of Michigan 20-Year Generating Resource Needs

MECS Resource Gap Analysis
Summer Peak Load and Resource Balance of Existing System



* Excludes Upper Peninsula

Central Station Technology Options

Technology	Size	$/kW	FOM ($/kW)	VOM ($/MWh)	Heat Rate
Sub-critical PC	500	1,478	44.26	1.86	9,496
Super-critical PC	500	1,551	44.91	1.75	8,864
CFB	300	1,628	46.11	4.37	9,996
IGCC	500	1,785	61.30	.98	9,000
IGCC-PRB	500	1,999	61.30	.98	10,080
Nuclear	1,000	2,352	70.04	.55	10,400
Combined Cycle	500	529	5.57	2.19	7,200
Combustion Turbine	160	425	2.19	3.83	10,450

Renewable Energy Options

Renewable Energy System Type	Portfolio Contribution In 2016 (MW)	Cost ($/kWh)
Wind	525	0.072
LFG	131	0.074 (New) 0.070 (Existing)
Anaerobic Digestion	82	0.082
Cellulosic Biomass	385	0.069
Total	**1,123**	

Energy Efficiency Programming

- High penetration (more aggressive/successful) energy efficiency program
  - 2015 = 7,436 GWh, 1,065 MW
  - 2025 = 14,383 GWh, 2,037 MW
- Low penetration (less aggressive/successful) energy efficiency program
  - 2015 = 4,331 GWh, 583 MW
  - 2025 = 8,280 GWh, 1,156 MW
- Active load Management = 569 MW
- Commercial Building Code = 195 MW

New Transmission Options

- TIER I Transmission upgrades into Lower Peninsula
  - 1,000 MW
  - $100 Million
- TIER II Transmission upgrades into Lower Peninsula
  - 2,000 to 2,500 MW
  - $800 Million (DC)

Planning Contingencies

- Fuel cost volatility
- Clean Air Act
- Transmission capability
- Demand growth

Planning Scenarios

- Traditional Generation
- Emissions
- Energy efficiency
- Renewable energy
- Combined energy efficiency and renewable energy
- Combustion turbines only

Sensitivities

- High demand growth
- Low demand growth
- Expanded transmission capability
- Low energy efficiency penetration

Central Station Base Case Results

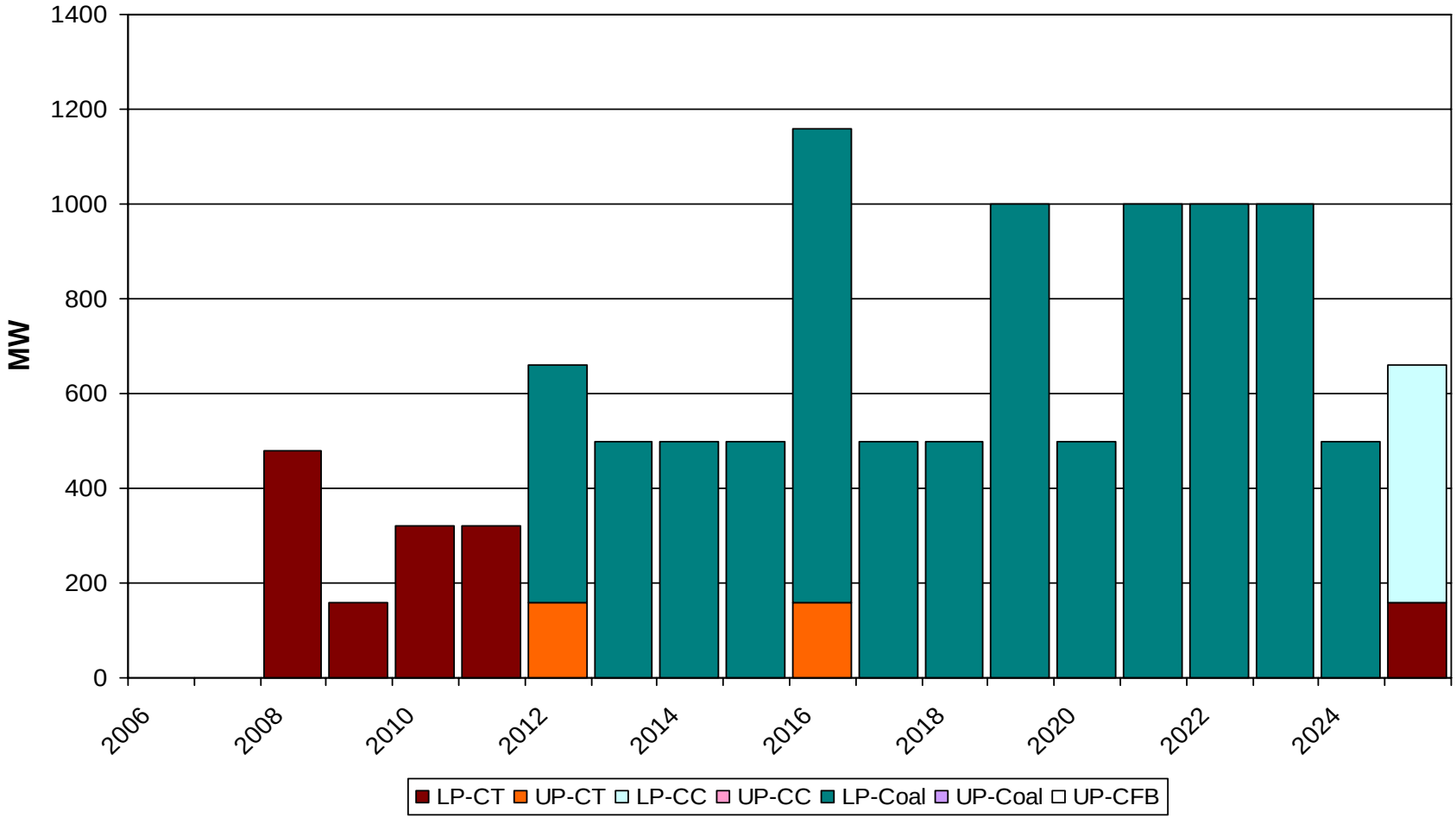
- 2006 to 2015
- Capacity Additions
  - CT 1,440 mw
  - CC 0 mw
  - PC 2,000 mw
  - Nuclear 0 mw
  - Renewable 0 mw
  - Conservation 0 mw
- Total 3,440 mw

- Demand Growth 1.17 %
- Reserve Margin 15.26 %
- Plan Costs
  - NPV Utility Cost $ 32,073.0 M
  - NPV Emissions $ 3,385.6 M
  - NPV CO2 $ 0.00 M

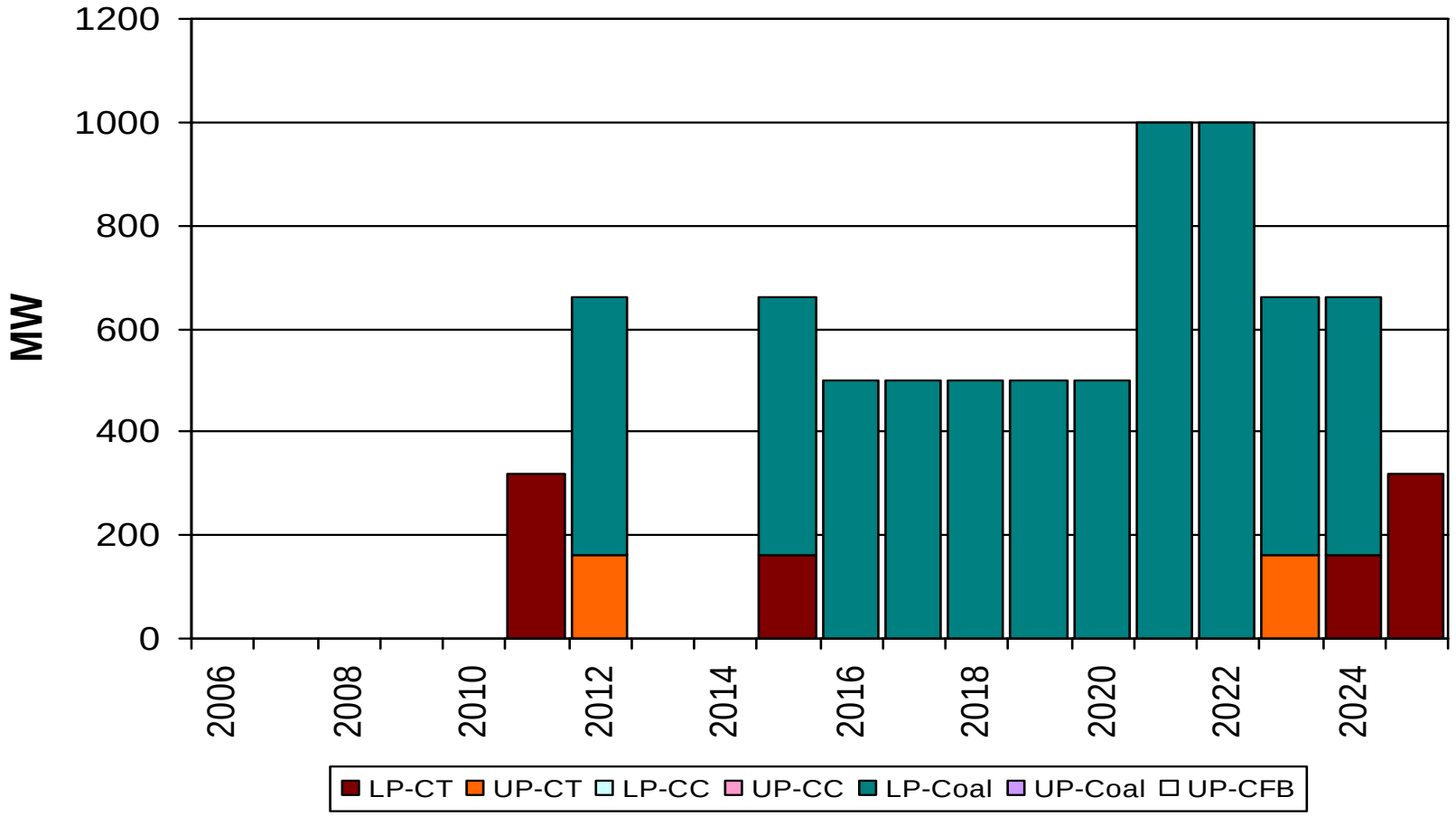
- 2006 to 2025
- Capacity Additions
  - CT 1,760 mw
  - CC 500 mw
  - PC 9,000 mw
  - Nuclear 0 mw
  - Renewable 0 mw
  - Conservation 0 mw
- Total 11,260 mw

- Demand Growth 1.21 %
- Reserve Margin 15.52 %
- Plan Costs
  - NPV Utility Cost $ 56,716.9 M
  - NPV Emissions $ 5,602.8 M
  - NPV CO2 $ 0.00 M

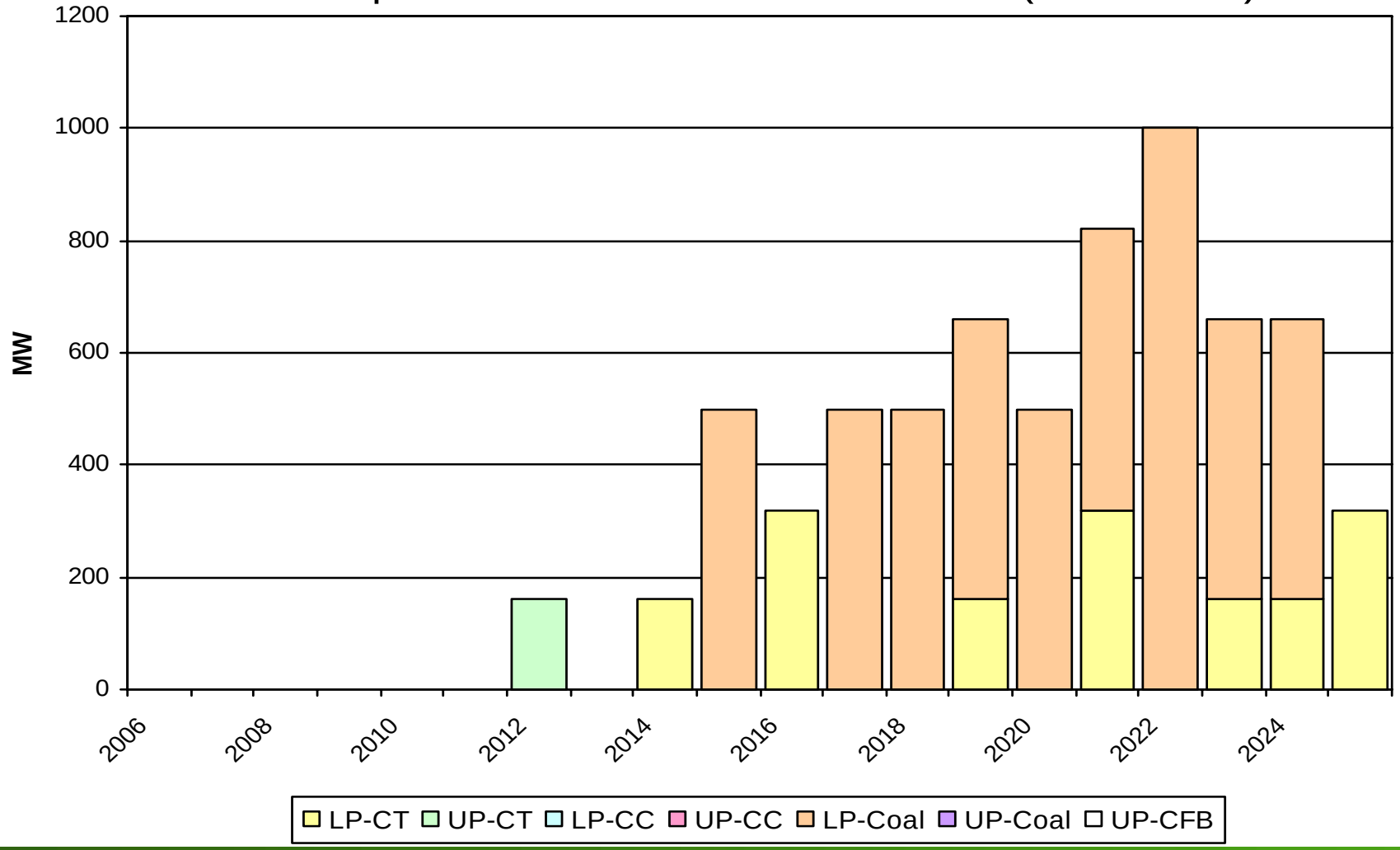
Lower Peninsula (METC/ITC) and Upper Peninsula (ATC-Z2) Central Station Base MW Expansion Plan Schedule 2006-2025



Lower Peninsula (METC/ITC) and Upper Peninsula (ATC-Z2) Energy Efficiency Base MW Expansion Plan Schedule 2006-2025



Lower Peninsula (METC/ITC) and Upper Peninsula (ATC-Z2)
Energy Efficiency & Renewable Generation
Base MW Expansion Plan Schedule Scenario (2006-2025)



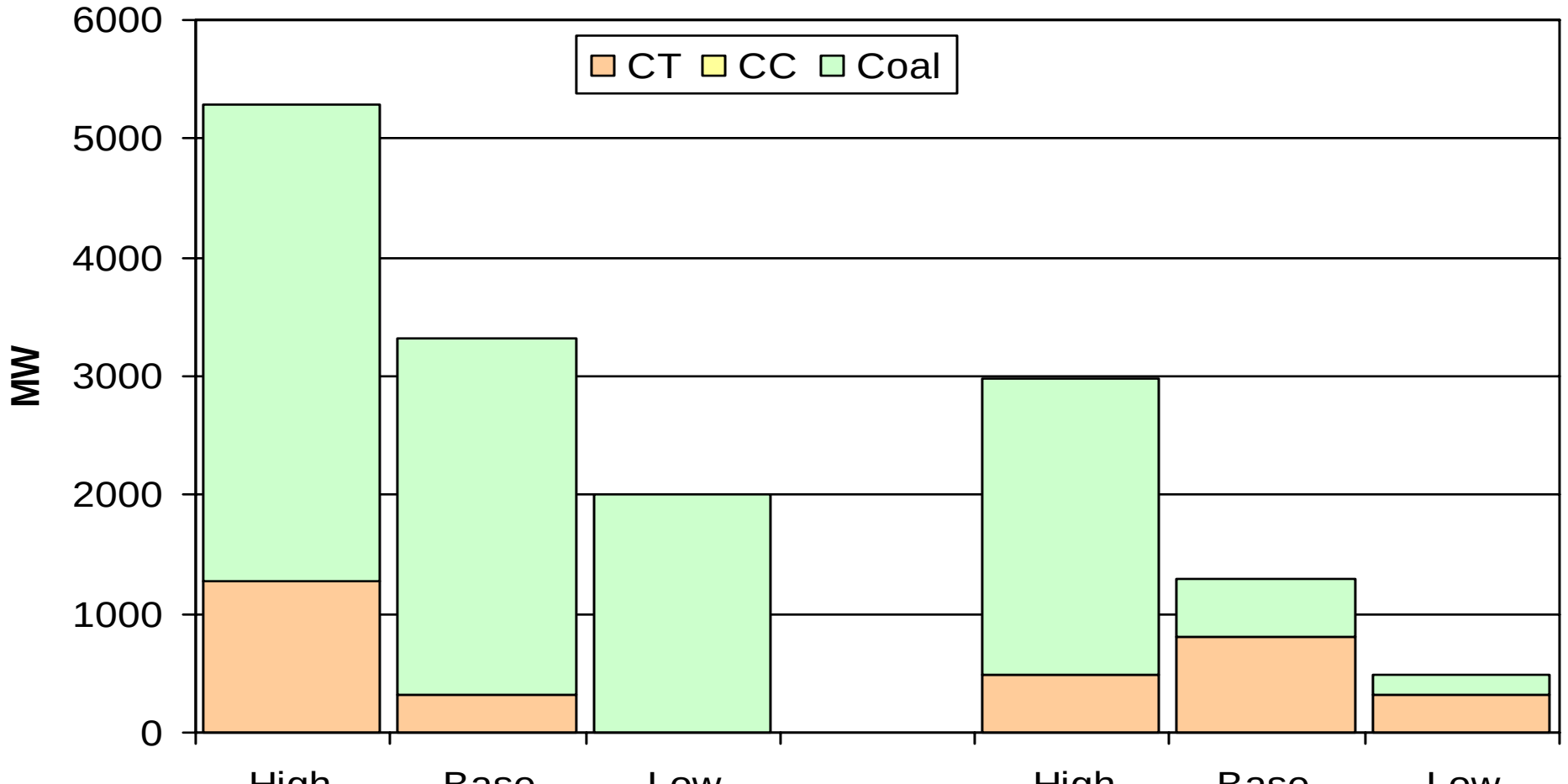
Twenty Year Planning Results

Plan Name	Total Capacity Added mW	CT Capacity mW	CC Capacity mW	PC Capacity mW	Nuclear Capacity mW	Renew-able Capacity mW	Energy Efficiency mW	Ending Reserve Margin %	Ending Peak Demand mW	PVRR $M
Central Station	11,260	1,760	500	9,000	0	0	0	15.52%	29,856	$56,716.9
CS High Load	15,040	3,040	2,000	10,000	0	0	0	15.63%	32,841	$64,116.8
CS Low Load	7,640	640	500	6,500	0	0	0	15.95%	26,870	$49,811.6
CS Reduce Import	11,220	2,720	1,000	7,500	0	0	0	15.40%	29,856	$57,004.8
CS Expanded Trans	10,300	800	1,000	8,500	0	0	0	12.56%	29,856	$57,085.5
Emissions	10,760	1,760	1,000	2,000	6,000	0	0	16.04%	29,856	$70,752.2
Emissions High Load	14,240	2,240	2,000	4,000	6,000	0	0	15.26%	32,841	$79,492.7
Emissions Low Load	7,480	480	0	1,000	6,000	0	0	17.69%	26,870	$62,254.7
Emissions Renew & EE	10,079	480	500	500	5,000	798	2,801	16.89%	26,404	$66,179.2
Emissions EE Only	11,261	960	0	1,500	5,000	0	2,801	16.53%	26,404	$66,707.5
Renewable Generation	11,218	1,920	500	8,000	0	798	0	16.28%	29,856	$58,081.4
Renewable High Load	14,698	2,400	2,000	9,500	0	798	0	15.48%	32,841	$65,343.3
Renewable Low Load	7,238	1,440	0	5,000	0	798	0	15.55%	26,870	$51,382.5
Energy Efficiency	10,581	1,280	0	6,500	0	0	2,801	15.73%	26,404	$53,794.5
EE High Load	14,241	1,440	2,000	8,000	0	0	2,801	15.45%	29,320	$61,040.0
EE Low Load	6,781	480	0	3,500	0	0	2,801	15.53%	23,488	$47,384.1
EE Reduce Pen	10,700	1,280	0	7.500	0	0	1,920	15.36%	27,269	$55,765.2
EE & Renew	10,359	1,760	0	5,000	0	798	2,801	15.95%	26,404	$55,207.9
EE&R High Load	13,899	800	2,000	7,500	0	798	2,801	15.28%	29,320	$62,365.1
EE&R Low Load	6,579	480	0	2,500	0	798	2,801	15.86%	23,488	$48,992.6
EE&R Reduce Penetration	10,518	800	500	6,500	0	798	1,920	15.70%	27,269	$57,130.8
CTs Only	11,200	11,200	0	0	0	0	0	15.34%	29,856	$58,987.6
CTs Only High Load	14,880	14,880	0	0	0	0	0	15.18%	32,841	$68,096.6
CTs Only Low Load	7,680	7,680	0	0	0	0	0	16.09%	26,870	$50,737.5

METC: High-Base-Low

Traditional vs Energy Efficiency & Renewable Generation

Load Growth Scenario over 20 years: 2006-2025



Planning Results

- Reliability concerns continue to exist for Southeast Michigan in the 2009-2010 period
- Energy efficiency and renewable energy options can lower future power costs and offset costs that may arise from greenhouse gas controls
- Energy efficiency and renewable energy options can eliminate or defer the need for additional natural gas fueled generating units
- Numerous scenarios and sensitivities choose additional base load generation when the schedule permits construction
- Further study is needed on a major transmission expansion

Alternative Technologies

- Stirling engines
- Fuel cells
- Solar applications
- Advanced energy storage
- Micro turbines
- Intelligent metering
- “Smart Grid” technologies

Policy Initiatives

- Central Station
- Renewable Energy options
- Energy Efficiency
  - Efficiency measures
  - Load management
- Distributed generation

Policy Issues

- Michigan's hybrid electric market makes it difficult for anyone to build a new power plant
- Additional legislation is needed for energy efficiency and renewable energy options to play a role in Michigan's future
- The Michigan Public Service Commission's policies need continual review to assure they do not undermine new energy technologies

http://www.dleg.state.mi.us/mpsc/electric/capacity/energyplan/index.htm

Michigan's 21st Century Energy Plan